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THEORY

OF THE

HUMAN

SENSATIONS.

By MARMADUKE BERDOE, M. D.

> ——non tam Cerebrum, quàm *Cor* ipſum, primum principium eſſe judicemus——
> *Exercitatio:* HERV. 56.

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THEORY

OF THE

HUMAN SENSATIONS.

THE ſenſations have hitherto been too much conſidered in a metaphyſical ſenſe; I ſhall endeavor to explain what they really are in the human body.

I have already endeavored to ſhew, how much more probable it was, and how ſatiſfactory the reſults have always been, when the ſeat of human ſentiment, was conſidered as fixed in the

precordial

precordial region, that is to ſay in the heart rather than the brain.—This opinion ſeemed to gain a great degree of credit, from the ſentiments of Mr. Hervey, which placed the ſeat of animal life within the heart.—Borelli has proved alſo ſince his time that the diaphragm acts as a ſpring, to direct the various efforts of the body. The tonic movements of the ingenious Staahl ſuppoſed an active force, in the primitive fibres of all thoſe organs which comprehended the circle of animal exiſtence, or in other words, in the general ſtruggle of the organic parts which determined their mutual influence, and efforts to each other.

The firſt attempt therefore, towards the inveſtigation of the human ſenſations, will be, to aſcertain the extended influence of the *diaphragm, phrenic-centers,* or the *precordial region*, and their various effects on the animal faculties.

The human body can neither act nor make any effort, without a very evident contraction of thoſe parts, which are ſituated near the diaphragm and the rectus muſcle of the abdomen.—Without this contraction, the body would become incapable of thoſe ſpontaneous and neceſſary efforts, to which it is determined, either by the influence of the will, or the idea of its own ſafety.

We obſerve likewiſe, that when the muſcles have long been under the influence of various efforts, a degree of laſſitude, ſeems to manifeſt itſelf in the region of the diaphragm: more eſpecially ſo, when theſe efforts have been continued, either very ſeverely, or for a conſiderable length of time.—The organs of this region, are in ſuch caſe, peculiarly affected, becauſe it is they which have been the moſt employed.—Borelli obſerves that the diaphragm is peculiarly affected when we aſcend a precipice or ſtairs, or uſe a more than common degree of force.—This muſcle ſeems therefore to be the principal center, of the animal forces.

One obſervation may be offered in proof of this laſt aſſertion, which is, the uneaſy feel, or kind of pain, which ſeveral perſons find, when the body is laid in an horizontal ſituation, and its immediate ceſſation, when they ſtand upright.

It were to be wiſhed, that ſome certain and juſt theory could be given, why the peculiar ſenſibility of the whole machine, ſeems as it were to be concentrated, within the ſmall ſpace of the body, called the pit of the ſtomach. —Anatomical enquiries have left us very uncertain as to that point, for very little is to be reaped from diſſections of the part.—And if conjecture may be allowed, it ſhould ſeem probable, that this great degree of ſenſibility is owing to ſome peculiar properties in the neighboring organs.

To conſider this circumſtance with more attention, we find that the *diaphragmatic centers* are thoſe only in the human body, which are in a continual ſtate of action.—The impreſſions of the ambient air, put the diaphragm in motion, which ceaſes with our exiſtence. Let not the objection however be too ſeverely urged againſt me, that in various diſorders of the body, and feminine affections, the breath is ſcarce to be perceived, or that perſons have lain as it were for ſeveral days together in a trance, without any apparent degree of ſentiment or motion, and who ſoon after have performed all the vital functions with the ſame regularity as before the accident. For I might in ſtrictneſs obſerve, even in this caſe that the diaphragm will appear to be at leaſt, the point of appuy, for the muſcular forces of the body. All that I want to prove, is, that from its continued and almoſt inceſſant action, it forms a general *center* towards which the nervous influence,* ought as conſtantly to be directed.—If this is allowed, I aſſert that there muſt be an intimate and continued connection between the brain, and the

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* By the nervous influence I mean that peculiar property by which the various nerves of the human body perform its different functions. It may perhaps be a nervous fluid, or an electric principle, but this at preſent is foreign to our deſign.

diaphragmatic centers, or elſe the nervous influence could not *tend* towards them, with ſuch invariable energy. Let me remark, however, that the nervous influence is not directed towards the *diaphragmatic centers*, by the active influence of the brain.—The brain is in itſelf more inactive and inſenſible than many other ſubordinate organs of the human ſtructure.—But in fact it is the conſtant and ſuperior energy of the diaphragm alone, which attracts the nervous influence towards its own center, as it would be directed in courſe to any other organ, that was equally as active.

The active powers of the *diaphragmatic centers* may then very reaſonably be ſuppoſed to have a primitive and ſuperior impulſe on the brain and muſcular forces of the body by attracting the nervous influence. The brain has likewiſe a degree of power over the *diaphragmatic centers,* which it exerts in return. This harmony of active impulſe is the grand baſis of the Human Senſations, which we ſhall next proceed to enquire into.

It may eaſily be imagined, that whatever objects make an impreſſion through the organs of the ſenſes, muſt conſequently increaſe the intrinſic action of the brain. The increaſed action of the brain muſt unavoidably then, and at the ſame time, either ſuſpend for a moment, or diminiſh in ſome peculiar degree, the relative action of the *diaphragmatic centers.*—This circumſtance will acquire more certainty from the following conſiderations, *viz.* The human body has in itſelf but a determined quantity of action, which is diſtributed into each reſpective organ of the frame, as into ſo many detach'd centers. Whatever organ, therefore, becomes active, either from a ſpontaneous or neceſſary influence, muſt conſequently deprive the neighbouring organs of ſome part of their reſpective forces. For the functions of the body are not performed from an increaſed degree of action in every organ, but from their reſpective proportions of exiſtence variouſly modified,—From hence we deduce this general axiom, *viz.* That no one part of the body can move, but from the diminiſhed action of ſome other part.

From this circumſtance it is aſſerted, that the brain, when occupied by its object muſt, from its increaſed action, diminiſh the peculiar portion of ſome other organ,—Now as the moſt intimate connection prevails between the brain and the *diaphragmatic centers*, it ſhould follow, that theſe centers participate the ſooneſt of this unequal diſtribution of the forces, and the increaſed powers of the brain. It has already been obſerved, that the *diaphragmatic centers* were the moſt active organs of the human ſtructure,—Now the firſt effects produced on the precordial region by the active powers of the brain, are manifeſted in certain elevations of the diaphragm, proportioned to their influence. The elevations of the diaphragm cannot happen without affecting the whole inteſtinal canal to which this muſcle is connected; nor can the inteſtinal canal purſue its periſtaltic action, without the rectus muſcle of the abdomen participating in theſe motions: and to complete the whole, the rectus muſcle of the abdomen will communicate again by its influence to the whole exterior ſurface of the body which forms what is called the exterior organ of it.*

If we conſider the connection of the ſpinal with the intercoſtal nerves, we ſhall find that the leaſt contraction of the exterior organ will ſoon affect the inteſtinal canal; which laſt, in conſequence muſt continue its action on towards the diaphragm.—By theſe mutual efforts of the brain, the diaphragmatic centers, inteſtinal canal, muſcles of the abdomen, and the exterior organ; a juſt center of *appuy* is completed, and without which the body would be deprived of its loco-motive powers, or become incapable of vanquiſhing the leaſt reſiſting obſtacle.

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* See Eſſay on the Circulation of the Blood.

This harmony of actions, and due efforts of the animal organs, ſeem to correſpond with the ſentiments of Hippocrates on the ſtate of illneſs, the reſult of an undue harmony in the various organs.—*Unaquamque vero corporis* pars altera alteri, *quum hinc vel illinc* proruperit, *ſtatim morbum facit.*

Reaſoning alone, although from undoubted obſervations, will have the appearance of a futile and vain theory, unleſs you bring experiment to its aid:—With an intention, therefore, of giving a greater degree of certainty to theſe new opinions, the following experiment was made on a living dog.

A ſmall apperture was cut in the belly of the animal, ſo as to admit a portion of one of the inteſtines to appear externally.—Two lateral inciſions were made ſoon after, extending from the xiphoid cartilage to the ſpine. The diaphragm enter'd immediately into ſtrong and evident convulſions, far more violent than thoſe which it appeared to have when the firſt inciſions were made. The whole inteſtinal canal followed the influence of this muſcle,—For at each contraction of the diaphragm, the meſentery and inteſtinal canal ſeemed to lift themſelves in weak undulations towards the umbilical region. As the animal expired, the contractions of the diaphragm became weakened and leſs frequent: the portions of the inteſtinal canal ſeemed to follow the ſame variations; and both ſubſided afterwards with each other.

It is evident in this caſe that the contractions of the inteſtinal canal* proceeded from the increaſed effort of the diaphragm, for the contractions of the diaphragm affect the meſentery, which laſt by augmenting the efforts of the inteſtinal nerves, muſt force them into a ſtate of vicious irritation.

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* The inteſtinal canal is form'd of various circumvolutions. I diſtinguiſh it from the term of

The experiments made by the ingenious M. De Lamure, after Schlintig, prove the great connection between the diaphragm and the dura-mater.*—It is

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interior region, becauſe the laſt implies the whole internal ſtructure of the trunk from the mouth and œſophagus, including the ſtomach, liver, ſpleen pancreas heart, kidnies, and in ſhort every viſcus contained in the belly, whereas the inteſtinal canal includes thoſe membraneous tubes only, which reach from the pylorus to the rectum.

* The following experiments were tried by M. De Lamure, and will ſerve to illuſtrate the opinions of Mr. Hervey and myſelf, concerning the intimate connection between the brain and the diaphragm.

more than probable, therefore, that the ſame action which we find was communicated by the diaphragm to the inteſtinal canal was carried on from the diaphragm to the dura-mater. This

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After trepanning a young dog, the brain covered by the dura-mater was obſerved to riſe and fall in exact meaſure with the elevation and depreſſions of the diaphragm, as in inſpiration and expiration.

Theſe ſucceſſive motions of elevation and depreſſion, became conſiderably increaſed when a ſmall portion of the dura-mater had been cut away.

After tying the trunks of the carotid arteries in a ſtrong dog, the animal laid in a ſtate of inſenſibility.—In this ſituation part of the ſkull was taken off without diſcovering any apparent motion in the brain, tho' the dura-mater had alſo been cut away.—The ligatures on the carotid arteries were taken off, and the brain had the ſame ſucceſſive motions as in the preceding experiment.—*Vide Recherches ſur la pulſation des Arteres, et les mouvemens du Cerveau dans l'Homme et les Animaux trepannès.*—P. 128, 129.

experiment might eaſily have been tried, by trepanning the animal, at the ſame time the lateral inciſions were made from the xiphoid cartilage. But where conviction itſelf ſeems to leave us without any doubts, it is unneceſſary to ſacrifice a whole hecatomb of animals, for the ſake of controverſy.

The action of the exterior organ* was conſidered as neceſſary to muſcular motion, but it has a much more extenſive influence on the animal œconomy. For the exterior organ furniſhes ſuch a continued ſource of reaction to the interior region, that without its influence the ſtrict union between the diaphragm and brain, muſt intirely ſubſide. The functions of the animal œconomy chiefly depend therefore, on the intimate connections between the head, the diaphragmatic centers,* and the exterior organ.—There is this difference; the exterior organ of the body does not only equal, but perhaps exceed the other two in powers, and is far inferior to either of them in the proportions of animal ſenſibility.—Now the conſequences of its diminiſhed ſenſibility are ſuch, that whenever the *exterior organ* of the body

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* For the term exterior organ, ſee my Eſſay on the Circulation of the Blood. The exterior organ comprehends the whole external ſurface of the ſkin. That the ſkin is neceſſary to muſcular motion, is proved by its inert ſtate in every hemiplegia or palſy.

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[*] Diaphragmatic centers, phrenic centers, or the precordial region, have all of them one and the ſame meaning, that is to ſay, they comprehend thoſe parts of the body which are ſituated under the coverings of the epigaſtric region, but more particularly the part which is bounded on each ſide by the right and left hypochondres, and called præcordia vel ſcrobiculus cordis.

is influenced by any cauſes which will produce a degree of vicious irritation on the ſkin, its effects will not occaſion either ſo ſudden or ſo violent effects upon the conſtitution, as when they proceed from the vicious irritations of the diaphragm or the brain. The reaſon is obvious,—The action of the exterior organ depends in part on the impreſſions it conſtantly receives from the various conſtitutions of hot and dry, or cold and moiſt air, but the undue efforts of the brain and the diaphragm generally proceed from ſome more violent and internal cauſe, rather than any primitive effects from the circumambient atmoſphere.

Before we quit the ſubject, it may be proper to mention a few circumſtances concerning ſome anatomical inſpections in that part of the exterior organ, which covers the diaphragmatic centers, commonly called the pit of the ſtomach.—It offers at firſt view a very complicated ſtructure, and ſhews at the ſame time an evident connection with the diaphragm. For the peritonæum and all the inſertions of the muſcles of the abdomen and the linea alba, do unite in ſeveral places, and are mixed with the tendinous parts of the diaphragm.—Theſe prolongations form ſome part of the aponeurotic membrane, and by communicating with the cellular ſubſtance, ſeem more peculiarly adapted to promote a due connection between the exterior and interior organs: for there are ſo few nerves in this part of the body, that if its ſenſibility depended upon them alone, we ſhould very much doubt of any, or at leaſt ſhould not ſuſpect that peculiar degree of exquiſite feelings which we find in the diaphragmatic centers.—But it is evident from obſervation, that the ſenſibility of certain parts of the body, depends as much on its peculiar ſtructure, as on the quantity of its nerves. It is for this reaſon we aſſerted that the nervous fibrils of the organs were not ſo much the inſtruments of their active powers, as the cauſe* which determined their motions.

The tendinous inſertions which were found ſo abundant near the diaghragm do ſeem to confirm the opinion that this part of the body, is the general center of the whole exterior organ.—We may be allowed at leaſt to ſuppoſe, as the tendons are the moſt ſenſible parts of the muſcles, that the tendinous inſertions do the ſame offices as thoſe which incloſe the muſcular fibres,—For, in fact, the ſkin ought to be conſider'd only as a membraneous and nervous veil covering the whole ſurface of the body, whoſe points of re-union are in the diaphragmatic centers.

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* Enquiry into the Structure of Animated Beings. P. 15.

Every violent effort, or long continued exerciſe, is in general followed by a manifeſt contraction in this part of the exterior organ. Hence we conſider the ſkin as one continued tendon, or aponeurotic muſcle, compoſed of many irregular fibres, but whoſe mechaniſm is peculiar to itſelf,—For it is in a great degree ſuſtained and directed by the efforts of this aponeurotic muſcle, at the pit of the ſtomach.

We have already mentioned that the exterior parts of the diaphragmatic centers are covered over by certain tendinous prolongations communicating with the *rectus* muſcles of the abdomen. We find that the diaphragm may be conſider'd, likewiſe, as having ſeveral muſcular fibres near its circumference, and tendinous ones near its center.—This mechaniſm ſeems intended by nature to afford it a more peculiar connection with the exterior organ.

The effects of external agents never fail producing ſome degree of irritation in the exterior organ by their impulſe, ſo likewiſe the exterior organ will have a continued influence on the diaphragmatic centers, and expoſe them to more or leſs frequent contractions. the inteſtinal canal becomes more violently agitated in return, and affords a due equilibrium to the increaſed action of the exterior organ.—Theſe contractions are continued on, likewiſe, from the diaphragm to the brain.

The mechaniſm of the human ſenſations conſiſts, therefore, in different modifications of active influence, or harmony of action, between the exterior organ, oppoſed to the impulſe of external cauſes, and the interior region of the body, comprehending the inteſtinal canal, the diaphragm, and brain.

The birth of children is probably the firſt moment in which the brain becomes affected by the impulſe of external cauſes. The agitations of the child, its tears, and inattentive examinations of objects, are ſo many proofs of an exiſting impulſe from theſe external cauſes and their neceſſity in promoting the action of the various organs. But we are to conſider that theſe primitive impulſes are as gentle as ſuch tender organs are capable of receiving. For the ſoft and pulpy fibres of the child diminiſh every active impulſe,—We are not therefore to conſider the tears of children as always expreſſive of pain, but as the conſequence of that one ſame cauſe, which is to put the diaphragm in motion for reſpiration, and to diſcloſe as it were the various neceſſities of its exiſtence.

It often happens that children remain for ſome moments after birth in a ſtate of inactivity, but at length by a kind of general agitation, the diaphragm begins its efforts, and completes the firſt function of the animal œconomy in reſpiration,—This agitation, the effect of a rarer element, and a powerful contraction of the diaphragm, is one of the moſt evident proofs, that this muſcle is the principal and primitive cauſe in determining the action of every other part of the body.

During the ſtate of Fætus, the diaphragm ſeems ſuſceptible only of a few irregular ſpaſms, produced by its own tonick movements, or ſome ſlight offending cauſe. But in conſequence of thoſe irritations which the air produces on the child, and principally by its paſſage through the noſtrils, the diaphragm often enters into ſuch rapid contractions as to put the whole body into convulſive motions.

The diaphragm which in children ſeems to fill up the whole cavity of the breaſts, when it contracts itſelf, muſt conſequently occaſion a ſpace within the lungs; into which the air will throw itſelf by its weight and elaſticity.—The inſpiration is conſequently produced by ſuch contractions, for the air fills up nearly the ſame ſpace in the breaſt of the child, which the diaphragm had left by its contraction. But as theſe contractions of the diaphragm, are and ought to be conſidered as neceſſary (though contrary to the welfare of the animal œconomy, when too long continued) it muſt follow, that this muſcle ſhould ſubſide, and become as it was before the inſpiration. By this mechaniſm the pectoral muſcles, which had been forced by the contraction of the diaphragm, will, in their turn, cauſe that neceſſary preſſure on the lungs, (as the muſcle ſubſides) to force out the air accumulated within their cavity, and to complete the firſt expiration.—Theſe gentle agitations of the diaphragm then, are the primitive ſketches of the human ſenſations.

We are likewiſe to conſider that theſe efforts are by no means limited to the diaphragm alone, for they are found to extend their influence, even to the moſt remote organs of the body. When this muſcle, for example, contracts itſelf in inſpiration, it muſt evidently follow that the whole inteſtinal canal, participates in theſe contractions: the conſequence of which will prevent the periſtaltic motions of the inteſtines,—For as the diaphragm contracts itſelf for the offices of inſpiration, it muſt force the whole inteſtinal canal which is connected with it into a ſmaller ſpace; but when once the offices of expiration are completed, it throws it off again with greater violence towards the inferior parts of the abdomen. The muſcles of the lower belly act at the ſame time in concert with the diaphragm,—The offices of reſpiration, are therefore by no means to be conſidered as limited to the lungs, ſince we find that every viſcus of the lower belly muſt participate in theſe motions.

Before we quit this ſubject, we muſt not forget to mention, that the colon, appears not only formed but ſituated in ſuch manner as to ſerve both as a reſervoir, and at the ſame time as an *appuy* to the whole inteſtinal canal. It ſeems to modify the active powers of the diaphragm by reſtraining the liver, ſpleen and ſtomach; for as the two firſt have but little action in themſelves, and the ſpace occupied by the latter is leſs conſiderable than when it is filled with aliment, it might happen that by their weight and inactivity they would reſtrain the power of the diaphragm, did not the colon, (which at this time receives the aliment from the ſtomach) ſupply that re-action, which the ſtomach loſes.

Our next ſtep is to conſider the action of the diaphragm, as influencing the nervous ſyſtem of the whole body.

A great plexus extends all along the ſpine and is to be conſider'd as connected with the nerves of each viſcus in the abdomen. Hence it follows, that the nerves of the inteſtinal canal, when put in action by the efforts of the diaphragm, will communicate their actions in part, to every viſcus of the abdomen; and again by means of thoſe nerves which reach along the ſpine, to their general origin the medulla oblongata, or the brain.—This plexus is found to have an intimate connection with the grand ſympatic nerves, and with that plexus on the breaſt (which are partly derived from the ſympatic) as alſo with the eight pair of nerves when irritated by the ſwelling of the lungs; from all theſe circumſtances duly conſidered it ſhould follow then, that every nerve of the human body muſt participate in the motions of the diaphragm.

Animal life conſiſts chiefly in the active impulſe of an elementary principle which is contained in the atmoſphere ſurrounding animal bodies, and irritates the diaphragm; communicating itſelf alſo from thence to the whole inteſtinal canal, and re-acting again from the inteſtinal canal to the diaphragm; and from this laſt to the whole Exterior Organ. By theſe agents that due harmony of action and re-action is completed between the exterior and interior parts of the human ſtructure; which conſtitute the true criterion of health, and exquiſite ſenſations,—For we are to conſider, that an undue action or re-action of either of theſe parts, muſt unavoidably occaſion an unproportioned effort in the various organs of the body, and ſoon throw us into a ſtate of illneſs and infirmity.

Unamquamque vero, ſays Hippocrates, *corporis pars altera alteri, cum hinc vel illinc proruperit ſtatim morbum facit.*

Hoffman has ſaid ſomething to the ſame purpoſe, which, as it will ſerve to confirm our opinion on the influence of the diaphragm and inteſtinal canal with the whole nervous ſyſtem I ſhall beg leave to mention.

Ex omnibus partibus, nulla majorem communicationem cum capite & univerſo nervorum genere habet, quam ventriculus & inteſtina.

Such are the human ſenſations conſidered in the theory.—Uninſtructed and without a maſter every Animated Being feels in alternate meaſures, the pleaſing or diſpleaſing emblems of his exiſtence. At one time his ſenſations lift him above the world in an exquiſite idea of happineſs. At another period, life becomes a burthen, and marks in iron characters, a ſevere and painful exiſtence.

Thus from two very different and oppoſite cauſes, the ſcene of human life is variouſly chequered by pleaſure and infirmity.—Every individual who exiſts is ſenſible of theſe changes, tho' he knows not their origin.—This circumſtance is the next matter for conſideration: we begin therefore by dividing the human ſenſations into two parts, *viz.* into

Pleaſing and *Painful Senſations.*

Pleaſing ſenſations may be defined by all thoſe cauſes, whether accidental or acquired, which increaſe the ſentiment of our exiſtence, or forcibly enchain us in the poſſeſſion of thoſe objects which may be called the idols of human happineſs,—Theſe ſenſations can only depend on the cauſes already mentioned which comprehend a due harmony or concert of actions, acting with equal and proportioned efforts between the exterior organ of the body oppoſed to the impulſe of external cauſes, and the interior region including the inteſtinal canal, the diaphragm, and brain.—This point is to be examined.

The five ſenſes ought to be conſidered as ſo many different mediums, thro' which the brain becomes affected by external cauſes.—If the impulſes which they produce upon that organ are gentle and unruffled, the diaphragm will ſoon participate in theſe pleaſing efforts, and continue them on through the whole inteſtinal canal.

The brain in ſuch caſe becomes as it were an intermediate center between the impulſe from external cauſes and their actions on the interior ſtructure of the human body. For every nerve reaches to the common ſenſory, from whence (when the brain is perfect and unhurt) the impulſes of the different external agents, are communicated to the diaphragm, and deſcribe on that muſcle, or the phrenic centers, the increaſed action of the brain.—For it was aſſerted in the beginning of this eſſay, *that no one organ of the body, could either exert a greater degree of action, or be put in motion, without an apparent diminution of the power of ſome other connected part.*

When the brain is put in action by the impulſe of an external agent, its ſpring and efforts are apparently increaſed,—The diaphragm as the moſt eſſential organ, and having the moſt intimate connection with the brain, is peculiarly affected, and either ſo ſuſpended or increaſed in its contractions, as to become deſcriptive of either the pleaſurable or painful ſenſations.

In ſome caſes it happens, that the brain, being hurt, ſtill receives the influence of its object, but remaining in an inactive ſtate cannot continue on its efforts to the diaphragm,—The ſenſations in this reſpect are torpid and undeſcribed, and are only called the apperceptive ideas of the ſoul.

We have frequent examples of this apperception of objects in thoſe caſes where the brain, (either from a wound or too great an afflux of the fluids) is in a ſtate of abſolute compreſſion, and conſequently incapable of any reminiſcence of ideas, or of any influence upon the motions of the diaphragm. The individual in this caſe,* ſees the perſons aſſembled round his bed, hears the conſultations of the phyſicians, or obſerves the chirurgical apparatus for the trepan: but has not the leaſt idea, that either the anxieties of his friends, or the preparations of the ſurgeons, in any way concern himſelf.

We have proofs on the other hand, of the debilitated and inactive powers of the diaphragm.—In many perſons the faculty of reaſon has not apparently been injured, if we might have judged ſo of them, from the perfect continuance of every accuſtomed function of the brain. Such perſons, however, though poſſeſſing every ſeeming degree of reaſon have at the ſame time loſt all apparent remains of a juſt and due ſentiment.—The loſs of the deareſt and moſt intimate friends and relations gives no degree of affliction—mothers have ſeen their own children torn from their arms and murdered before their eyes, without ſhedding a tear, or ſhewing the leaſt ſenſible emotion.—Theſe uncommon phenomena have been chiefly obſerved to happen at or near the firſt attacks of certain malignant fevers,—The ſame has been diſcover'd in the laſt ſtage of the conſumption, when the lungs and the pleura have been filled with ulcers, or in certain paroxyſms of the hypochondriac affection.

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* Vide Berlin memoirs, on the apperceptive powers of the ſoul, by M. Sulzer.

Can we poſſibly account for theſe uncommon phenomena by any other cauſe, than the reciprocal actions between the brain and diaphragm? In the firſt caſe the diaphragm is unhurt and performs its accuſtomed functions, but the brain being incapable of acting, the reminiſcence of ideas are but ſlightly traced out, and penetrate no farther than the limits of its own ſphere of action.—The brain in the ſecond caſe ſeems to poſſeſs its own degree of action, and receives the impulſe of external objects on the common ſenſory; but the diaphragm being oppreſſed, (as it certainly is in malignant fevers and the conſumption) is incapable of confirming the ideas of the brain. For in thoſe perſons where the reaſonable faculties ſeem perfect, it muſt appear erroneous to aſſert that there can be any vicious defect in the brain, that is capable of extinguiſhing the proper degree of ſentiment.

From this ſuppoſed harmony of active impulſe between the brain and diaphragm, it will appear, that the reaſonable faculties conſiſt chiefly in a certain reminiſcence of ideas. Now it is very probable that the relative action of the brain may deſcribe the active impulſe of external objects in itſelf without the aid of the diaphragm. But the true and perfect ſentiment cannot be accompliſhed without the ſenſations are confirmed, which never can happen unleſs the ideas formed in the brain are determined and fixed within the phrenic centers or the diaphragm.

It may eaſily be comprehended that the due re-actions of the diaphragm are often defective, and interrupt, if not abſolutely

ſolutely deſtroy, the relative functions of the brain. It is manifeſtly the caſe in thoſe fevers which have a malignant character, but particularly in the catalepſy,—This diſorder (with thoſe juſt mentioned) conſiſts in ſuch dangerous convulſions of the diaphragm that they are ſometimes capable of aboliſhing every ray of human ſentiment, and are often as proportionably dangerous as the diſorder appears to have either a great or leſs degree of malignity.

The effects produced upon the body by the primitive ſenſations, are to be conſidered as a neceſſary influence cauſed by external objects upon the brain,—The different ſenſations are cauſed in conſequence, by the various degrees of impulſe which external objects excite upon the principal ſource of the nervous ſyſtem in the brain, and the reciprocal action of this organ upon the diaphragm, precordial region, or what was called the phrenic centers.

Add to this, likewiſe, that there are other ſenſations proceeding from an internal cauſe, which may be called ſecondary, to diſtinguiſh them from the firſt or primitive ſenſations.—The primitive ſenſations have been conſidered as proceeding from an external cauſe upon the brain.—The ſecondary are generally produced from an internal cauſe, affecting the inteſtinal canal.

This diviſion of the ſenſations into *primary*, or *ſecondary*, will not in the leaſt deſtroy the former opinion, which diſtinguiſhed them as pleaſing and painful ſenſations: for whether they proceed from either an internal or an external cauſe, they are equally affected in pleaſure or in pain.

After what has already been aſſerted concerning the reciprocal harmony of active impulſe between the brain and the diaphragm,—And after the eſtabliſhed axiom juſt mentioned, *That no organ can be put in motion, or become active, without diminiſhing the apparent and relative action of ſome other,** Will it, I repeat, from all theſe circumſtances duly conſidered ſeem improbable that the ſenſations ſhould depend on various modifications of exiſtence in the ſeveral organs of the body?

If, for example, the brain and diaphragm were uniformly to preſerve each their due degree of action in themſelves, no real ſenſations could poſſibly enſue. For, in this caſe, tho' the various landſcapes of ſurrounding nature ſhould paint themſelves on the retina, or the juſt and pleaſing concords of harmonious ſounds ſhould burſt through the vibrating air to the auditory nerves, yet theſe impulſes would all be ſo concentrated within the brain, that the Being would ſcarce receive more than a paſſive and undetermined influence from each.—It is abſolutely neceſſary, therefore, that the various objects which are conveyed to the common ſenſory, ſhould not only ſtimulate, but by this ſtimulus ſhould likewiſe increaſe the relative action of the brain.

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* See Lord Bacon's Natural Hiſtory, Cent 8. Exp. 722.

The brain increaſed in its action by the influence of external cauſes, muſt deprive ſome other organ of part of its accuſtomed proportion.—The diaphragm as the neareſt and the moſt active, will be that which the ſooneſt participates in the various changes which happen in the brain,—From this very circumſtance a diſgregation and diminution of the animal forces muſt evidently follow.—The increaſed efforts in the brain deprive the diaphragm of part of its action, ſo that the powers of the phrenic centers muſt conſequently be in ſome degree ſuſpended.

Theſe diſgregations* in the organical forces muſt have either a greater or leſs influence upon the animal œconomy relative to their continuance.

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* By the word diſgregation I mean a diviſion of a certain thing into any given number of parts which added together form a ſum equal to the whole. For example, let the brain be equal to three parts, the diaphragm five, the ſtomach four, and the inteſtines four, the agregrate of theſe ſums amount to ſixteen.—Now a diſgregation of theſe parts will happen if the ſtomach has five, the inteſtines two, the brain five, and the diaphragm but four, for although the aggregate be the ſame, yet there is an undue proportion of parts, as the brain has more than its own quota, and the diaphragm leſs. All this I mean to ſignify in the word diſgregation.

Such viciſſitudes of action from the brain to the diaphragm, or from the diaphragm to the brain, will ſtill have a more dangerous tendency when too long continued in a ſtate of muſcular exerciſe. For as the diaphragm has been proved (not only by Borelli but by ſeveral other perſons) to be the center of *appuy* for all the muſcular movements of the body, it will evidently follow, that as the brain, in the act of thinking and occupied by its object, deprives the diaphragm of ſome degree of action, it muſt ſuffer much more in a ſtate of exerciſe, which demands a conſiderable augmentation of forces in the phrenic centers to aid the various efforts of the muſcles.—Animal life would therefore be but of very ſhort duration deprived of that pleaſing ſtate of oblivion in which the brain ceaſes to perpetuate the impulſe of external objects, and the body tired out with toil, repoſes itſelf in a decumbent poſture, inattentive, and inactive.

The pleaſing ſenſations of animal exiſtence are, as mentioned before, the reſult of that equal and due harmony of action between the ſeveral organs of the body when agitated by external cauſes, and aided by the efforts of correſponding parts without injuring them.—Painful ſenſations are conſequently produced by the relative actions of certain organs being increaſed, when the correſponding parts are too weak to ſupport their action: or when the acting organs are in ſuch a ſtate of ſpaſm as to become incapable of perpetuating the impulſe. Such is the caſe when the eye perceives ſuch objects as from the horror they excite in the brain, cauſe it to act ſo ſudden, and with ſuch influence towards the diaphragm, as to throw this center into a ſtate of abſolute ſpaſm.—When this happens the motions of the diaphragm are ſo curbed, that life ſeems almoſt extinguiſhed, reſpiration is ſuſpended, and the pulſe becomes imperceptible.

Painful ſenſations may likewiſe be produced from certain ſpaſms of the exterior organ* (the ſkin) whether occaſioned by the conſtrained efforts, or ſuſpenſion of the diaphragm, or from various changes in the ſurrounding atmoſphere.—When this happens, the different fluids which circulate through the

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* Vide Eſſay on the Circulation on the Blood.

the cellular-ſubſtance of the body, towards the exterior organ* of it, are driven in greater abundance towards the interior region, and oppreſs the tender blood-veſſels (by diſtending them) through the whole inteſtinal canal. It is not poſſible to explain by any other reaſon, why certain perſons are conſtantly troubled with pains in the ſtomach, in north-eaſterly winds and a damp ſtate of the atmoſphere,—Or why other perſons are troubled with ſickneſs and vomitings on dipping their hands in cold water, or laying them upon a cold marble ſlab.—Theſe two laſt examples, tho' they do not come within the natural effects of the atmoſphere, are yet produced from a ſimilar cauſe. For cold of any kind will corrugate the ſkin, and by occaſioning thoſe ſmall elevations (which we call *gooſe-ſkin*) ſhew it to be in a ſtate of ſpaſm, and

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* Lord Bacon in his obſervations and experiments on animal bodies, ſeems to have known this fact, for what this author calls the *parts*, means the ſame thing with what is here called the exterior organ of the body. See his natural hiſtory, Cent. ix. 877. or his experiments concerning frictions. How can every friction or active power applied to the external ſurface of the body, make the exterior organ more active in its whole extent? unleſs the agents are ſo violent as to throw it into a ſpaſmodic ſtate. For what can I mean more, by promoting the action of the exterior organ ſo as to draw the current of the fluids to-

wards the ſurface of the body, than what Lord Bacon has already noticed, when he ſays that frictions make the parts (exterior organ) more fleſhy? (i. e. more active, by which means the current of the fluids are directed towards it, as they always tend to the moſt active organ,)—"the cauſe" according to his Lordſhip's definition is, "*for that they draw greater quantity of ſpirits and blood to the parts.*" We muſt obſerve however, that the ſenſations in this caſe are agreeable, for the inteſtinal canal is always leſs oppreſſed when the fluids circulate externally.

conſequently unable to promote the *external circulation of the fluids.

The convulſive ſtate of the diaphragm has likewiſe been found to have produced a ſimilar effect. There are certain accords or diſcords in muſic which have that peculiar influence upon the body, that they make what ſome perſons term, *the blood run cold.* It is certain that ſome pieces of muſic ſeem as it were to †chill us, or to give us at leaſt a leſs perfect ſenſation of warmth, than we probably felt before their performance.—I have known ſeveral perſons faint on hearing certain paſſages in

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* Vide Eſſay on the nature and Circulation of the Blood.

† Lord Bacon's Natural Hiſtory, Cent. 8. Exp. 793. Old edition, by W. Rawley, printed in 1631.

Handel's muſic. How can we account for theſe effects, but by the mechaniſm juſt propoſed? The brain collects certain ſounds with more pleaſure than others, and conſequently irritates the diaphragm with a greater or leſs degree of influence. In the caſes juſt mentioned the diaphragm muſt have been ſo ſuſpended as to become irregular in its elevations and depreſſions. If theſe regular efforts of the diaphragm are ſuſpended, the exterior organ by its intimate connection muſt equally ſuffer, and conſequently become incapable of receiving the fluids which would circulate through its whole extent when unconſtrained.—But it is certain that the ſtate of ſpaſm and contraction which it evidently ſuffers render it improper for its accuſtomed functions. In this caſe the circulating fluids are driven internally, and oppreſs the interior parts of the body by their too great quantity.—The blood-veſſels lining the whole inteſtinal canal, render the interior region of the body ſo inactive through its whole extent, as to become incapable of counteracting the ſpaſms of the exterior organ and the perſon faints, and loſes his motive powers.

The ſecondary ſenſations are chiefly produced by internal cauſes. We obſerve this peculiarity in the ſenſations: if the fluids circulate towards the brain they are not diſpleaſing, but when they tend too abundantly towards the bowels they produce that moſt diſagreeable of all ſenſations, called horrors and ſinking of the ſpirits. Theſe ſenſations, however, are generally the reſult of undue efforts in ſome peculiar organs.—If the brain has been too long in action it may perhaps have produced a mania, or phrenſy, but where it aſſerts ſcarce more than its due degree of action, the circulating fluids produce no diſagreeable ſenſations.—But when the bowels are affected, be it from whatever cauſe it will, life is embitter'd and the ſenſations are painful.

The intention of the preſent eſſay is to ſhew the mechaniſm of the human ſenſations in the ſtate of health, and conſequently can take no cogniſance of painful ſenſations from unnatural cauſes, ſuch as pains of the gout, ſtone and rheumatiſm, &c. For as theſe ſenſations are the conſequence of an imperfect ſtate of exiſtence, it muſt follow that their deſcriptions would amount to nothing more than a theoretical deſcription of diſeaſes.

FINIS.

☞ This pamphlet was juſt finiſhed, when the Review of March was brought to me by a friend to let me ſee how ſeverely I had been criticiſed, by the learned body of the Monthly Reviewers.

Tortured and vexed, I was going to throw all this theory into the fire if it had not occurred to me, that two heads are oftentimes better than one,—Pleaſed with the thought, I called up my cook-maid, and bid her run her eye very carefully over the whole.—She liked it, and approved of my publiſhing.

Under the ſanction then of her *great authority* I boldly venture once more to requeſt *your great* deciſion: I flatter myſelf I ſhall pleaſe you, for tho' my cook-maid is not ſo learned as a Reviewer, ſhe is as excellent an *old woman* as the beſt————.